

outwards by a similar process, so that there is a continuous transference of oxygen by a sort of Grotthus chain of unstable copper oxide molecules. This view is in harmony with the fact that cupric oxide, the most easily reducible of the oxides investigated, is the one which parts with its occluded oxygen most easily, at the same time obstinately retaining the nitrogen, whilst the oxides of zinc and magnesium, being more stable, retain the oxygen persistently. It was found that the electrical conductivity of copper oxide was much increased at a temperature approaching redness, whilst that of zinc oxide was much less increased, and that of magnesium oxide not at all. This would be explained by the copper oxide being to a certain extent dissociated by heat, and permitting of some metallic conduction. Cupric oxide was found to give up oxygen steadily when heated in vacuo to 790° , cuprous oxide being found in the residue.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*, ♀) from India, presented by Mr. A. Urban Smith; six Snow Buntings (*Plectrophanax nivalis*), European, purchased; three Grey Squirrels (*Sciurus cinereus*) from North America, deposited; a Great Eagle Owl (*Bubo maximus*), bred in the Gardens.

Errata.—In the necrology of Prof. Allman, p. 202, line 18, delete "Regius"; p. 204, line 37, for "Grumera" read "Gunnera."

OUR ASTRONOMICAL COLUMN.

COMET CHASE.—The following ephemeris of Comet Chase is a continuation of that which we have previously published from Herr J. Möller's computation:—

1899.	R.A. (app.) h. m. s.	Decl. (app.)	Br.
Jan. 1 ...	11 5 50	+29 23'5	...
7 ...	6 45	29 46'1	...
9 ...	7 33	30 8'7	...
11 ...	8 14	30 31'5	...
13 ...	8 48	30 54'6	...
15 ...	11 9 15	+31 17'9	...

PLANET WITT (DQ 1898).—Although only of the twelfth magnitude, planet Witt should be closely followed and good positions measured as opportunities afford. The accompanying ephemeris for the coming fortnight will prove useful to those whose instruments are large enough to follow this interesting body.

Berlin Midnight.

1898.	R.A. h. m. s.	Dec.
Jan. 5 ...	23 3 0	+4 37'6
7 ...	7 51	5 3'3
9 ...	12 45	5 29'6
11 ...	17 42	5 56'1
13 ...	22 44	6 23'0
15 ...	27 48	6 50'2
17 ...	32 56	7 17'7
19 ...	23 38 6	+7 45'4

The above ephemeris, calculated by Dr. E. Millosevich (*Astr. Nachr.*, 3532), requires, according to an observation by Dr. Cerulli, a correction of about $-5s.$ in R.A., and $-0'3$ in declination.

ASTRONOMICAL PHOTOGRAPHY WITH SMALL INSTRUMENTS.

—The earnest worker, even with only small means at his disposal, may perform important work in astronomy by the aid of lenses of comparatively small aperture. The great advances made in the sensitiveness of dry plates helps us now to photograph quite easily objects which formerly presented a great difficulty.

By replacing the eyepiece of a good telescope with a small camera, with a suitable positive or negative lens, very useful work can be done, although the scale of magnification need not be very great. The employment of a negative lens makes the instrument more convenient for use, as a shorter telescope tube can be utilised.

One great function of photographs of celestial objects is to record changes in the appearance of bodies or regions studied. In the case of the former large images are required, and the photo-telescopes are the most suitable; in the latter, large fields, but not necessarily very large magnification, are required for many purposes of great interest. In the *Photographische Correspondenz*, Herr P. Zschokke points out in an interesting article the useful work an amateur can accomplish by means of small instruments, and gives an interesting table showing the relative sizes of apertures, focal lengths of objectives, focal lengths of combinations, &c. Since, in this class of instrument, the size of the diameter of the image formed is the main point, we give below the table containing these values, which has been reproduced in the *British Journal of Photography* (December 23, 1898). All the figures in the following columns refer to millimetres.

Aperture.	Focus of objective.	Focus of tele-photo combination.	Entire length of telescope.	Diameter of image of sun or moon.
51 ...	730 ...	5370 ...	980 ...	50
81 ...	1218 ...	8060 ...	1350 ...	75
108 ...	1624 ...	11370 ...	1960 ...	108
135 ...	1949 ...	16115 ...	2365 ...	150
135 ...	1353 ...	16115 ...	1800 ...	150
162 ...	2599 ...	32230 ...	3510 ...	300
162 ...	2599 ...	24170 ...	3155 ...	225

A NEW VARIABLE IN CASSIOPEIA.—Dr. T. D. Anderson, writing in the *Astr. Nachr.* (No. 3533), states that the star which has the position for 1855, R.A. 23h. 37'm., and Decl. $+55^{\circ}45'$, is a hitherto unnoticed variable. This star, which is not recorded in the BD, was first seen by Dr. Anderson in the beginning of 1897, and was then only 0.2 magnitudes fainter than $+55^{\circ}3007$, the magnitude of which was then fairly estimated as 9.0. In September 23 of the same year the star was found missing, although another star of magnitude 10.3 could be easily seen 3' to the north of the missing star. Subsequent searches failed to pick up the same star again; and Dr. Anderson, coming to the conclusion that the object was probably a Nova, only examined the region very occasionally.

Last month, however, on the 5th, he again examined the region, and at last found the object of his search. At this time it excelled in brilliancy its neighbour of magnitude 10.3 by as much as it was itself surpassed by BD $+55^{\circ}3007$.

OBSERVATIONS OF α ORIONIS.—Mr. R. T. A. Innes, writing from the Cape Observatory (*Astr. Nachr.*, 3533), mentions that he has been observing α Orionis (Betelgeuze) on several evenings, and the star was found to be only slightly brighter than Aldebaran. Last season, as Mr. Innes states, Betelgeuze was twice as bright as Aldebaran, which is its ordinary state. From this observation it may be concluded that one of the irregular minima of Betelgeuze is approaching.

PRIZES PROPOSED BY THE PARIS ACADEMY OF SCIENCES FOR 1899.

THE following are the prize subjects proposed by the French Academy of Sciences for the present year.

The Bordin Prize (3000 fr.) for a study of the questions relating to the determination, properties, and application of systems of orthogonal curvilinear coordinates of n variables, indicating particularly, in as precise a manner as possible, the degree of generality of these systems; the Francœur Prize (1000 fr.) and the Poncelet Prize (2000 fr.), for useful work in the field of pure and applied mathematics. In Mechanics is offered the Extraordinary Prize of 6000 francs, for any invention increasing the efficiency of the French naval forces; the Montyon Prize (700 fr.), for the invention or improvement of instruments useful to the progress of agriculture or the mechanical arts; the Plumey Prize (2500 fr.), for any invention contributing to the progress of steam navigation; the Tournayon Prize, for an improvement in any point of the theory of pumps. In Astronomy, the Lalande Prize (540 fr.), for the most interesting or useful astronomical observation made during the year; the Valz Prize (460 fr.) for astronomical work. In Physics, the La Caze Prize (10,000 fr.). In Statistics, the Montyon Prize (500 fr.). In Chemistry, the Jecker Prize (10,000 fr.) for discoveries in organic chemistry; the Cahours Prize (3000 fr.) for the encouragement of research in young chemists already known by their published work; and a La Caze Prize of 10,000 fr. In Mineralogy and Geology, the Delesse Prize (1400 fr.), and the

Fontannes Prize (2000 fr.) for researches in palæontology. In Biology, the *Grand Prix* of the Physical Sciences (3000 fr.) for a study of the biology of Nematods, especially the forms and conditions of their reproduction, and the Bordin Prize (3000 fr.). In Botany, the Desmazières Prize (1600 fr.) for work on the Cryptogams; the Montagne Prizes (1000 fr. and 500 fr.) for important work bearing on the anatomy, physiology, development, or description of the lower Cryptogams; and the Thore Prize (200 fr.) for the best memoir on the cellular Cryptogams of Europe. In Anatomy and Zoology, the Savigny Prize (975 fr.) for the assistance of young travelling zoologists. In Medicine and Surgery, a Montyon Prize for discoveries or inventions having a direct bearing upon the art of healing; the Barbier Prize (2000 fr.) for similar objects; the Bréant Prize (100,000 fr.) for the discovery of an absolute specific against Asiatic cholera; the Godard Prize (1000 fr.) for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Serres Prize for a memoir on general embryology applied as far as possible to Physiology and Medicine; the Chaussier Prize (10,000 fr.) for the best book or memoir which has appeared during the last four years, either in medicine, legal or practical medicine; the Bellion Prize (1400 fr.); the Mége Prize (300 fr.); the Lallemand Prize (1800 fr.) for work on the nervous system; and the Baron Larrey Prize (1000 fr.) for a memoir on military or naval medicine, surgery, or hygiene. In Physiology, a Montyon Prize (750 fr.); a La Caze Prize (10,000 fr.); the Pourat Prize (1400 fr.) for a memoir on the specific characters of the contraction of different muscles; and the Philippeaux Prize (890 fr.) for work in experimental physiology. In Physical Geography, the Gay Prize (2500 fr.) for a study of the Mediterranean mollusca, and a comparison of these with those found on the French oceanic coasts.

Other general prizes offered for 1899 include the Arago Medal, the Montyon Prize (unhealthy trades), the Trémont Prize (1100 fr.), the Gagner Prize (4000 fr.), the Petit D'Ormozy Prizes (10,000 fr. each), one for work done in mathematics, and the other in natural science; the Leconte Prize (50,000 fr.), the Tchihatchef Prize (3000 fr.), the Gaston Plante Prize (3000 fr.), the Houlléguie Prize (500 fr.), the Wilde Prize (4000 fr.), the Saintour Prize (3000 fr.), the Kastner-Boursault Prize (2000 fr.), the Jean-Jacques Berger Prize (12,000 fr.), and the Baron Joest Prize (2000 fr.).

Of these the prizes bearing the names of Wilde, Tchihatchef, Leconte, Desmazières, Delesse, La Caze, and Lalande are expressly stated to be offered without distinction of nationality.

MAGNETIC SURVEYS.¹

THE importance of magnetic survey work has been recognised for a long time. Many of the most eminent scientific men of the century now about to close have devoted much time and thought to magnetic observation and the reduction of results, and their labours have not been without fruit. To them we owe all that is known with certainty as to the magnetic state of the earth and its changes; and though observations have no doubt to some degree outpaced the work of reduction and the construction of theory, much has been done to construct from observational data a general theory of terrestrial magnetism. We have the great mathematical theory of Gauss based on the results of Sabine, Barlow, Horner, and others, with the answer it gives to the question of the locality of the magnetic distribution which gives rise to the ordinary phenomena of terrestrial magnetism. Also, and founded to some extent on Gauss's theory, we have now that of Schuster on the daily changes of the magnetic forces and their causes, which has yielded most important results, as to the locality of the sources of this periodic disturbance. As a consequence of Schuster's theory there have lately been published some important discussions of the diurnal changes and their theory by von Bezold and others.

The secular changes have received a great accession of interest since Bauer's first discussion of the subject some years ago in an inaugural dissertation at the University of Berlin. In that he gave the method of graphical representation of the secular changes now known by his name. An observer is supposed to look from the

centre of a magnet, freely suspended at its centre of gravity, and to note the curve which the north-pointing pole seems to describe, and which shows changes of dip as well as changes of magnetic declination. This mode of representation can, of course, be applied to the diurnal changes, and shows that though a complete cycle of secular changes is not yet available from observations, yet the diagram of the diurnal changes may serve to complete it. Let the secular changes be produced by the combination with a constant magnetic system rotating with the earth of a second system, also turning with the earth, but while doing so describing a secular orbit round the earth's axis. This is the hypothesis of Wilde. Now let a needle be imagined suspended outside the earth while the earth turns beneath it. The superimposed magnetic system will in the course of one rotation of the earth occupy the same position relatively to the suspended needle that it successively occupies in the secular period with reference to a needle fixed with the earth and turning with it. The curve thus obtained for a single day will, if the second system be invariable and its successive positions be symmetrical about the earth's axis, be the same as the secular curve. Though this curve cannot be directly observed, for no needle can be suspended in the manner supposed, the distribution of magnetic force round the earth is sufficiently well known to enable the positions of the needle to be calculated and the curve laid down on paper. The indications at the same instant of time of needles suspended at different points of the same astronomical circle of latitude, in fact, give the curve. There is sufficient similarity between the curves obtained in this way¹ to afford a fairly satisfactory first test of Wilde's hypothesis, and no doubt further progress in the solution of this interesting question will shortly be obtained by Dr. Bauer himself, or others.

The origin of the diurnal and secular variations may perhaps become known fully only when the secret of terrestrial magnetism itself is revealed. In the meantime there can be no question of the absorbing interest of the problem, and of the fact that the only way to solve it is by means of continued magnetic observation at different parts of the world, at sufficiently equipped and properly chosen magnetic observatories. It is to be hoped that as the value of observations, so far as the secular changes are concerned, depends on their comparison with those obtained much later in time, care will be taken in future by municipal and government authorities not to injure or render nugatory the work done by bringing disturbing electric currents and traffic into the vicinity of observatories. The fact that a sub-section (of Section A) of the British Association gave itself at the recent meeting to the discussion of terrestrial magnetic problems is at once an indication of fuller recognition of the interesting nature and the importance of magnetic research, and a guarantee that magnetic observatories and laboratories will be made to co-operate to the best advantage in the work to be done, and that everything will be done to induce authorities to protect them when powers are being sought for engineering projects.

Dr. Bauer has set before us a brief but interesting statement of the history of magnetic research, the objects to be served by it, the kind of survey work that may be attempted best by observers in different localities, and the mode in which it should be carried out, illustrated by an account of a survey of part of the State of Maryland which he has lately undertaken.

There are many notes of great interest in this historical sketch. For example we find, what we confess we did not know before, that the discoverer of the declination of the compass needle from the true north was Christopher Columbus. It seems that on September 13, 1492, Columbus crossed the agonic line, the line of no declination, a little to the west of the Island of Fayal in the Azores, and observed that the compass at places on the east of this line pointed east, and at places on the west pointed west of the true north. This line ran, curiously enough, along the old boundary between the kingdoms of Portugal and Castile. Generally Columbus has received credit only for discovering the agonic line, owing to a statement of Formaleoni, the Italian historian, that Bianco's chart of 1436 contained values of the declination, an error which Humboldt perpetuated by repeating in his "Cosmos." The recorded value of the magnetic declination at Rome in 1269, ascribed to Petrus Peregrinus, was inserted, it appears, by some one early in the sixteenth century, thus subsequent to Columbus.

That the declination had not been discovered sooner arose

¹ "Maryland Geological Survey. First Report upon Magnetic Work in Maryland, including the History and Objects of Magnetic Surveys." By L. A. Bauer. Special Publication, Vol. I., Part V. Pp. v + 125, with one plate. (Baltimore: The Johns Hopkins Press, 1897.)

¹ See Prof. Rücker's Rede Lecture, NATURE, December 23, 1897.